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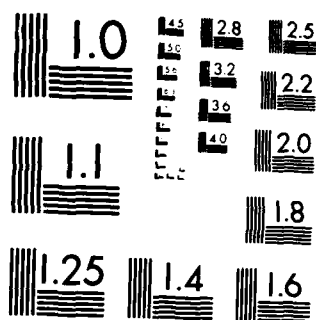
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ROYAL AIRCRAFT ESTABLISHMENT

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January 1983

**SWEDISH DEFENCE RESEARCH  
ABSTRACTS 81/82-4**

by

National Defence Research Institute, Stockholm

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Procurement Executive, Ministry of Defence  
Farnborough, Hants

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SWEDISH DEFENCE RESEARCH ABSTRACTS 81/82-4

[FRÖ FÖRSVARS FORSKNINGS REFERAT 81/82-4]

by

National Defence Research Institute, Stockholm

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D.P. Barrett

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EDITOR'S SUMMARY

The Swedish National Defence Research Institute issues a quarterly list of unclassified Reports published by the Institute. The titles of these Reports and informative abstracts have been translated in English. This volume is the Fourth issue of 1981/82. Further volumes will be translated in due course. The main topics covered are: protection - atomic, biological, chemical; ammunition and weapons; conduct of war, information and commands; vehicles and spacecraft; reliability and logistics; human factors; associated studies and their solutions; positive methods for limitation and control of armaments; psychology reports.

EDITOR'S NOTE

The Reports are in Swedish unless some other language is indicated (usually English). When requesting Reports it should be appreciated that an English version will not normally be available, and that the prices of the original Swedish documents have not been indicated in this Translation. Reports may be obtained from:

FOA Centralkansliet, Box 27322 S102 54 Stockholm, Sweden

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T CERTAIN MEASURES FOR LIMITATION AND CONTROL OF ARM. TENTS

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A PROTECTION - ATOMIC

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(181) FOA Report A 30030-A3

EMP protection capabilities of protective breakdown devices  
Berndt Backlund and others

October 1981

Commercial protective breakdown devices are not generally specified for transients in the nanosecond range. There has therefore been serious uncertainty as to whether they are sufficiently fast for protection against EMP currents with rise times greatly shorter than 100 ns.

An experimental investigation of protective breakdown devices was carried out, in which several different makes were studied, using pulses of up to 4 kV/ns steepness of the leading edge. It was found that the devices under test are sufficiently fast-acting to act as EMP protection. In order to use their fast action it is necessary for the lead-in conductors to be short enough to keep the inductance low.

The experiments also show that there is little to be gained by modifying the design of the spark gap and internal conductors, since most of the inductance is in the outer conductors. No appreciable improvement of protective capability could be determined on replacing the protecting unit by a short circuit.

In order to obtain fully-adequate protection against EMP protective breakdown devices should be combined with filters, which can be built as a unit. A simple theoretical model was constructed which explains the results obtained experimentally.

(182) FOA Report C 30264-A3

Report on a visit to Munster, West Germany, 23-27 November 1981

Torbjörn Karlsson and Berndt Backlund

February 1982

Place of visit: Wehrwissenschaftliche Dienststelle der Bundeswehr für ABC-Schutz

Purpose of visit: On the occasion of the formal inauguration of the first large German EMP simulator an international symposium was arranged, at which Torbjörn Karlsson was invited to read a paper. An opportunity was allowed for studying the EMP simulator and its measuring equipment, though not in operation, owing to our hosts' being engaged on duties connected with the symposium.

B PROTECTION - BIOLOGICAL

B1 Threat scenario

(183) FOA Report C 40150-B1

Text-formatting system for Diablo 1650 WP as part of VAX/VMS  
Alf Brunström

February 1982

The report describes a small text-formatting system for the print-out of documents at terminals of the type Diablo 1650 WP connected to VAX computers as part of the VMS operating system. The system permits the print-out of very high typographical quality and incorporates functions, eg for bold type, automatic right-hand justification, centring of text etc.

The system, which consists of a formatting program *DIADOC* and a print-out program *DIATYPE*, is intended for use in conjunction with a powerful VDU-oriented editor, eg EDT, though other types of editor can also be used.

The report also describes a program *DIASET*, by which it is easy to initiate Diablo 1650 for different line spacings, paper sizes, type wheels etc for subsequent print-outs.

The software described in the report permits systematic word-processing on the VAX system, from compilation of the manuscript to a final print-out of the completed document. Use of the system in the manner described means that various users can rapidly and easily produce documents of high typographical quality.

B2 Protective measures

(184) FOA Report B 40131-B2

Purification of firefly luciferase by ammonium sulphate precipitation and  
isoelectric focussing (in English)  
Arne Lundin and Arne Myhrman March 1982

A simple two-stage procedure for purifying firefly luciferase from crushed firefly tails is described. The two stages are precipitation by ammonium sulphate and isoelectric focussing. Particular emphasis is laid on the removal of any contaminating enzymes. These cause analytic interference in the analysis of adenine nucleotides. The ammonium sulphate precipitate, which corresponds to a saturation of 45-55%, can also be purified by isoelectric focussing in a sucrose density gradient without previous dialysis. Luciferase is precipitated at its isoelectric point, and can be collected by centrifuging. The preparation of luciferase obtained by this simple procedure is exhibited as a band in SDS gel electrophoresis and in analytic isoelectric focussing. The median total yield from the raw extract is 65%, and the increase in specific luciferase activity is 8 times. The level of contaminating enzymes is strongly reduced, *eg* adenylat kinase is reduced by 5500 times. Luciferase as purified by the method in this report has been successfully used in the analysis of adenine nucleotides, and is now commercially available, (LKB-Wallac, Turku, Finland).

Analyses of firefly luciferase are very well-suited for indicating and identifying microorganisms in air, water and food. This is due to the rapid and simple analytical procedure and high sensitivity.

Offprint from Bioluminescence and Chemiluminescence (1981), pp 453-465;

FOA Reprints 1981/82:16

C PROTECTION - CHEMICAL

C1 Threat scenario

(185) FOA report C 41051-C1

Ellipsometry as a measuring method for biochemical reactions  
Lars Berghem and others February 1982

The report describes an optical method for measuring changes in thin (mono-molecular) surface layers. One important application is that of biomolecules, *eg* proteins. The method is illustrated by an example of measuring an immunological reaction. The results show that this method is well-suited to the measurement of such reactions. The report contains an account of a number of reactions which in conjunction with ellipsometry can be used for measuring and detecting substances of importance for protection against ABC warfare agents.

The report illustrates the facilities available at FOA 4 for conducting interdisciplinary projects. The combination here is that of surface physics and measuring technique with biochemistry, microbiology and radiation biology. The text also contains an account of a number of similar simplified optical and electrical measuring methods which are likely to afford successful detection.

C2 Protective measures

- (186) FOA Report C 40152-C2  
Investigation of treated bentonite as a means of chemical decontamination  
Åke Broxvall February 1982

A number of preparations of bentonite, after treatment with various cations, were examined with a view to their suitability as decontaminants.

A potassium-bentonite preparation produced from "Greek bentonite" was found to have the best decontaminating properties. When compared with personal decontaminant No. 102, the calcium-bentonite preparation was equally good or better in decontamination from mustard gas, soman or substances resembling nerve gas.

The decontaminating effect of calcium-bentonite is based on the fact that it binds the chemical warfare agent by physical forces of adsorption. No chemical breakdown of a nerve gas could be determined.

- (187) FOA Report C 40153-C2  
Proposed exercise material for the atmospheric indication of nerve gas  
Jan-Olof Andersson and others May 1982

Ethyl diethylamide chlorophosphate can be used to simulate nerve gas for indication and decontamination exercises. The report describes the production both of the initial material and the final product.

Preliminary toxicological tests show that the substance is relatively non-poisonous and non-mutagenic, and it should therefore be handled according to the instructions in force for Class I antidotes. Its decontaminating abilities may be considered good as the substance has a short half-life in water. For distribution of it several types of spraying system have been studied. In atmospheric indicating tests using an indicator board under simulated field conditions, the exercise material could be detected at concentrations down to  $1-3 \text{ mg/m}^3$ .

C3 Injuries and treatment - chemical

- (188) FOA Report A 40040-C3 (C1)  
Enzymatic breakdown of nerve gas. The purification and characterisation of an enzyme which degrades nerve gas, prepared from pig's kidney, and a comparative study of enzymes from other sources.  
Göran Bucht and Gertrud Puu May 1982

As an alternative to treatment with atropine oxime for nerve gas injury, a therapy based on breakdown of the toxic substance in the bloodstream would appear promising. For this reason enzymes which will degrade nerve gases have attracted considerable interest, particularly about 30 years ago when the enzymes were discovered. Studies were then conducted on fairly impure enzyme preparations.

An enzyme which catalyses the breakdown of certain organophosphorus compounds, eg sarin and soman, has now been purified from pig's kidney with a good yield. The

kinetics of the enzyme have been studied. Calculation of the effectiveness of this and other similar enzymes has shown that enzyme therapy is not a practicable means of treatment.

D AMMUNITION AND WEAPON TECHNOLOGY

D1 Technology of explosives

- (189) FOA Report C 20452-D1  
Testing of base-flow charges  
Anders Schwartz

April 1982

A number of base-flow charges for ammunition of calibres, 75, 105 and 120 mm were tested with respect to the hardness of the propellant and adhesion of the insulation to the propellant. A number of block propellants were also tested for hardness. It is intended to repeat the measurements at about 5-yearly intervals to investigate any changes in the charges due to ageing.

- (190) FOA Report C 20457-D1 (D4)  
Investigation of electrical igniters for ammunition.  
Part 1: Data on igniters in Swedish ammunition and the state of knowledge of testing.  
Ola Listh

May 1982

An analysis of ammunition environments has been in progress at the FMV since 1974, the aim of which is to construct methods of testing for various environmental factors and the degrees of rigour under which testing is to be done. The FOA was tasked with studying that portion of this problem which concerns the sensitivity of electrical igniters to various forms of interference signal. The present report constitutes the first part of an account of this activity.

The report consists principally of a catalogue of those igniters which occur in Swedish ammunition and the data which are available on them. A list is also provided of the test methods which are or have been used for this purpose in Sweden, together with a description of some American methods for testing the sensitivity of igniters to electromagnetic radio-frequency signals. The report concludes with a proposal for some test methods which ought to be studied further.

D2 Gunnery technology and associated ballistics

- (191) FOA Report C 20456-D2  
Form functions for a 19-hole propellant  
Sven-Erik Flygar

May 1982

General relations have been derived for calculating the form function  $\phi(z) = s/s_0$  for a 19-hole propellant with a circular generatrix. The report concerns one case of calculating with this given geometry. Matching of  $\theta$  in the form function  $z = (1 - f)(1 + \theta f)$  has also been performed for this geometry.

A computer program has been written for calculating the form function  $\phi(z) = s/s_0$  for 7- and 19-hole propellant respectively with a circular or rosette-shaped generatrix.

- (192) FOA Report C 20458-D2  
Stability measurements and dispersion tests of projectiles with a triangular base plane  
Sven Nordström

June 1982

Stability measurements on the Northern Range and long-range dispersion tests were carried out with 7.5 cm projectiles with different nose cones and triangular base planes (TBP). This latter profile is based on the "Non-conical boattail" designed and patented by Anders Platou at BRL, Aberdeen Proving Ground. Three different lengths of the rear section were tested, of which the shortest with  $13^{\circ}$  taper of the bevelled plane afforded no substantial advantages. The combination of a 4.5 calibre long low-drag cone with 2.04 calibre TBP was totally unstable in the dispersion tests.

The best combination of 4.5 calibre low-drag cone with 1.42 calibre TBP yielded a gain at maximum range of about 13% or 3000 m compared with the basic type of 7.5 explosive shell m/40.

The rotation speed as measured by radar during dispersion tests decreases more rapidly with the TBP than with a conical stern.

Since the rifled length in the barrel appears to have been too short in these tests, further testing is recommended with different combinations of cone, rifling and triangular stern lengths.

#### D4 Technical aspects of warheads

- (193) FOA Report B 20036-D4  
Microstructural study of the deformation and fracture behaviour of a sintered tungsten-base composite (in English, Lars Ekbohm)

Studies of the effect of microstructure on the mechanical properties of sintered tungsten composites (W-Ni-Fe) have been previously reported (Scand J. Metallurgy 5, 179-184). In situ studies of deformation under the scanning electron microscope have shown how the tungstengrains in a nickel-iron matrix were deformed when the test bar was plastically elongated. It could also be observed how cracks were formed and grew to the point of fracture. Since these investigations were reported, experiments have been continued on the deformation behaviour of tungsten composites.

Tensile test bars of tungsten composites were deformed at different temperatures in a series of varying degrees of deformation from 1% up to fracture. Deformation of the microstructure and crack formation were studied on the test surface and in the interior of the material. Image analysis and micro-hardness testing were used to determine the deformation of the tungsten grains. The density of dislocations and the formation of micro-cracks were also evaluated.

The investigation showed that the mean deformation of tungsten grains was of the same magnitude as the macroscopic deformation, although the variation in individual grains was great, particularly on the surface of the test bar.

Microcracks were formed at an early stage in the deformation of the test bar on the surface, and in the interior of the material after about 15% plastic elongation at room temperature. The number of microcracks increased until the test bar fractured (36% elongation).

One conclusion which may be drawn from the experiments is that a distinct difference exists between deformation at the surface and within the material in this type of particulate composite.

(194) FOA Report B 20037-D4 (M3)

A proposed standard methodology for estimating the wounding capacity of small-calibre projectiles or other missiles (in English)  
R.H. Berlin and others

In order to evaluate the properties of splinters and projectiles from small-calibre weapons as regards their effects and wounding capacity, it is necessary to know how the energy of the projectile is transmitted to the target on striking, and in particular how much energy is released along the wound passage and at what point. These properties may vary over a wide range, especially for typical small-calibre fully-encased ammunition, when it penetrates the first part of the wound passage point foremost as on its external ballistic trajectory. The projectile then usually tumbles at different rates, which causes its ability to transmit energy to the tissues to increase very strongly.

A standard methodology is proposed in this report for estimating the energy transfer of small-calibre projectiles and other fast-moving objects as a function of the depth of penetration on striking the human body. The method is based on firing tests against a soft block of soap. The target blocks were evaluated by cutting them in two lengthwise along the cavity left in the block by passage of the projectile. The diameter of the cavity can be easily measured as a function of the depth of penetration. From these data the energy transfer function can be calculated for the greater part of the penetration process.

The method is very simple to apply and requires no access to sophisticated measuring or recording apparatus. It can be applied in all environments, including under field conditions.

A means of calibrating the method is proposed in order to ensure good accuracy. It first involves measuring the properties of the target material, which may vary according to its composition and manufacturer. The authors discuss the reliability and limitations of the method.

This report is one of the papers read to the 4th International Symposium on Wound Ballistics, Goteborg, September 1981.

Reprint from Acta Chir. Scand. Suppl. 508, pp 11-28, 1982:

FOA Reprints 1981/82:17

(195) FOA Report B 20038-D4 (M3)

Soft soap as a tissue simulant medium for wound ballistic studies investigated by comparative firings with assault rifles Ak4 and M16A1 into live, anaesthetised animals (in English)  
B. Janzon

In order to compare the relevant properties of a certain soft type of soap with those in live muscle tissue, a series of test firings were conducted both against blocks of the soap and live anaesthetised young pigs. Two different standard-pattern assault rifles were used in the experiments, the Swedish Ak 4 with sk ptr 10 prj ammunition, and the US M16A1 with M193 ammunition.

The passage of the projectiles through the respective targets was recorded by means of an experimental apparatus incorporating 8-11 flash X-ray tubes of the 105 kV and 150 kV types. The tubes were mounted in two nearly orthogonal planes, and the recordings were made in stereo. It was thus possible to obtain 4-6 determinations of the positions, angles of attitude etc of the projectile as a function of time in each experiment.

By evaluating the experiments and by superimposing the results of each series of experiments using the same weapon and ammunition subject to certain criteria, the retarding force on the projectile could be calculated with good accuracy as a function of the depth of penetration both for the soap targets and the experimental animals.

The result of the investigation shows no significant difference between the performance of the projectiles in live muscle tissue and the simulating medium.

The report derives from a paper read to the 4th International Symposium on Wound Ballistics in Göteborg, September 1981.

Offprint from Acta Chir. Scand. Suppl. 508, pp 79-88, 1982;

FOA Reprints 1981/82:18

(196) FOA Report B 20039-D4 (M3)

Edge, size and temperature effects in soft soap block simulant targets used for wound ballistic studies. (in English)

B. Janzon

A series of experiments was conducted in order to investigate the effects of various parameters in wound ballistic experiments, using soft blocks of soap to simulate live tissue. Spherical 6mm ball bearings of steel were fired from a smooth-bore tube at a target at a speed of about 1500 m/s. The target geometry (square or circular cross-section), eccentricity of the point of impact, size of the target block, temperature (0-20°C) and the method of evaluation were varied systematically.

Results of the investigation show the accuracy which can be expected when conducting this type of experiment. The limits are also indicated within which the parameters can be allowed to vary for the experiments to remain continuously relevant. In conclusion a model is presented for calculating the retarding force on the projectile as a function of its depth of penetration (= transfer of energy from the projectile to the target as a function of its penetration) solely by measuring the size of the resulting cavity in the block of soap after impact, with the dimensions and temperature of the block of soap as parameters.

It should be emphasised that the conclusions apply only to the particular medium being studied. However the results suggest that it should be possible to devise a relatively simple method of calibration to determine the material parameters required for other closely-related media.

The report derives from a paper read to the 4th International Symposium on Wound Ballistics, Göteborg, in September 1981.

Offprint from Acta Chir. Scand. Suppl. 508, pp 105-122, 1982;

FOA Reprints 1981/82:19

## E CONDUCT OF WAR - INFORMATION AND COMMAND TECHNIQUE

### E1 Reconnaissance, target location and fire control

(197) FOA Report B 30054-E1

Carbon-oxygen complexes as nuclei for the precipitation of oxygen in Czochralski silicon (in English)

G.S. Oehrlein and others

Changes in the IR absorption bands from different carbon-oxygen complexes in Czochralski silicon occur simultaneously with precipitation of interstitial oxygen

during heat treatment at high temperatures. Changes in the concentration of interstitial oxygen and IR absorption from the carbon-oxygen complexes can be influenced in the same manner by producing changes in the parameters of treatment such as temperature and the ambient gas. These results support the idea that carbon-oxygen complexes act as oxygen-precipitating nuclei in Czochralski silicon.

Offprint from Appl. Phys. Lett., (1982), 40, 3, pp 241-243;

FOA Reprints 1981/82:21

- (198) FOA Report C 30262-E1  
Sensor techniques  
Hans Bergdal and others

February 1982

The report gives an account of development trends in techniques and applications in the field of sensor technique. The first part is a broad outline of the subject, going on to deal with current technical developments under the various headings of: seismic techniques, acoustic and magnetic techniques, radar and microwave techniques, signal intelligence techniques, optronics and computer techniques.

The report forms part of the FOA 3 series INFORMATION TECHNIQUES, the aim of which is to trace more completely both scientifically and technically the state and trends of developments in information technology.

- (199) FOA Report C 30266-E1  
Properties of a wavefront behind a woodland screen at 139 MHz.  
Stellan Nilsson

March 1982

In order to map the appearance of a wavefront behind a screen of woodland, both field measurements and a computer simulation have been carried out. Both these methods are complementary, so that the field measurement shows both the wavefront and the amount of fading at two different places and at several distances from the wood, while the simulation shows at a high resolution the appearance of a wavefront with strong fading.

The report illustrates in the form of diagrams *inter alia* the phase, signal strength and distribution of signal strength in 14 squares measuring 20 m x 20 m.

- (200) FOA Report C 30273-E1  
An image-processing method for estimating position - a maximum-likelihood solution.  
Dan Andr  e (KTH) and   ke Wernersson

April 1982

The problem under consideration is how a position can be determined for a noisy partial image in relation to a larger reference image. The object of the study is to find methods of synthesising image-feedback control and navigation systems.

Estimation of position is based on a maximum-likelihood (ML) method. The stochastic variables in the ML method are the estimated edge coordinates for each scan. An analytical maximisation in one direction gives a substantial reduction in the volume of calculation. The position estimator can be analysed and the estimate is, or can be made, rugged.

- (201) FOA Report C 30275-E1  
A presentation of two models for pictorial edge detection  
Ulf Nilsson and others

(in English)  
May 1982

The report concerns two algorithms for edge detection. It presents the theory underlying each model, together with some results after applying the algorithms to digitised images. The theoretical limitations of the algorithms are also discussed.



E2 Communications

- (202) FOA Report C 30230-E2  
Simulation of auto-interference in slow frequency-hopping  
Krister Gunmar

September 1981

The report describes a computer program to simulate auto-interference in networks of asynchronously hopping frequency-hopping stations. Results are also given for such simulations, illustrating for example the influence of fading in a disturbed frequency-hopping link when in use.

- (203) FOA Report C 30265-E2  
OTT - a computerised ground-wave model for the VHF band with broken terrain having different soil characteristics.  
Göran Engdahl

March 1982

A computerised wave-propagation model designated OTT was run on the DEC-10 in FOA 3.

Its performance and potential were investigated both by studies of the mathematical and physical background of the model and by investigating the model's numerical properties.

Some mathematical examples are also given for propagation over broken ground approximated by a Gaussian barrier, and for propagation over land-sea-land.

The experience gained demonstrates that the OTT model is quite applicable in calculating transmission losses over broken ground having varying soil characteristics, up to and including the VHF band.

- (204) FOA Report C 30269-E2  
Control unit for frequency-hopping on short-wave radio  
Robert Kvarén

March 1982

This report gives a description of short-wave communication and a control unit for frequency hopping on short-wave radio.

The first part of the report covers the appearance of the ionosphere and the problems involved in short-wave communication.

The second part deals with how a feasible frequency-hopping system on short-wave radio should be constructed, together with a description/simulation of the control unit to be installed on the transmitter and receiver sides.

E3 Guidance, navigation and target identification

- (205) FOA Report C 20455-E3  
A limited study of TVC with a jetavator and jet rudder  
Ralf Eliasson

April 1982

Thrust Vector Control (TVC) for manoeuvring of jet-powered guided missiles was studied on a newly-developed test apparatus with a liquid-fuel rocket engine as the test object. The principal object was to develop an in-house capability in TVC by means of system studies.

The study was restricted to a number of engine tests with jetavators and jet rudders. The results are reported together with a comprehensive list of references.

- (206) FOA Report C 30267-E3  
Account of intensified research efforts into the radiation-sensitivity of LSI semiconductor circuits  
L. Hagström and others

February 1982

The report contains the results of an investigation into "the influence of new processes and component technologies on the radiation-sensitivity of LSI semiconductor circuits".

The investigation gives an account of an activity in FOA 3 in three different cost budgets.

## F VEHICULAR AND SPACECRAFT TECHNOLOGY

### F9 Materials

- (207) FOA Report B 20040-F9  
Carbon fibre reinforced epoxy prepregs and composites. Health risk aspects  
Monica Kowalska (in English)

Methods of production, starting from carbon fibre and epoxy resin matrices, via prepregs and composites to the finished product are discussed in stages in terms of their danger to health. The discussion is based on investigations into the chemical substances involved, and supplemented by an investigation of the literature.

Offprint from SAMPE Quarterly (1982), 13, 2;

FOA Reprints 1981/82:20

- (208) FOA Report C 20453-F9  
Pressure sintering of silicon nitride with MgO at 1550-1750°C  
Stephan Andersson and Knut-Fredrik Alm April 1982

Silicon nitride was hot-pressed with MgO (1-5%) at temperatures between 1550°C and 1750°C. The role of magnesium oxide in sintering was studied.

The process operates in two stages, one fast and one slow. In the first a migration of particles occurs, and in the second a diffusion of material via a secondary Mg-silicate phase.

Owing to sintering a conversion takes place of  $\alpha$  to  $\beta$ -Si<sub>3</sub>N<sub>4</sub>. The reaction is of the first order. The activation energy was calculated as  $-272 \text{ kJ} \cdot \text{mol}^{-1}$ .

Hardness measurements and bending tests were carried out. No significant difference was observed in hardness at the sintering temperatures. A certain amount of correlation exists between the yield strength and the quantity of added magnesium oxide.

## H HUMAN ENVIRONMENT

### H1 Investigations, future projections

- (209) FOA Report B 54024-H1  
Onset of blood lactate accumulation and marathon running performance  
B. Sjödén and I. Jacobs (in English)

The purpose of the present study was to investigate the relations between marathon running, the level of physical exertion at which lactic acid begins to accumulate in the blood (onset of blood lactate accumulation OBLA), the amount of training and the composition of muscle fibre. On the occasion of the Stockholm Marathon in 1979 eight male competitors underwent a test to determine the relation between running speed on a rolling belt and the accumulated lactic acid in the blood. A speed corresponding to  $4 \text{ mmol} \times \text{l}^{-1}$  lactic acid was defined as  $V_{\text{OBLA}}$  ( $V$ , velocity). A muscle tissue biopsy was taken from m. vastus lateralis, which was examined for the percentage of slow muscle fibre (% ST) and capillary density. With the speed of marathon running as the dependent variable,

multiple regression analysis showed that  $V_{OBLA}$  alone accounted for 92% of variation in  $V_M$ ;  $V_{OBLA}$  taken with the amount of training undertaken before the marathon increased the explanatory value to 96% of variation in  $V_M$ . All the performance variables ( $V_M$  and  $V_{OBLA}$ ) were positively correlated with the percentage of slow muscle fibre ( $r = 0.55$  to  $0.69$ ) and capillary density ( $r = 0.52$  to  $0.63$ ). Hence a strong connection exists between marathon running and  $V_{OBLA}$ , and also between marathon running and the ability to run during the race close to the speed corresponding to OBLA. These properties in turn were related to the percentage of ST fibres, capillary density and amount of training.

Offprint from Int. J. Sports Medicine (1981), 2, pp 23-26;

FOA Reprints 1981/82:23.

(210) FOA Report B 54025-H1

Onset of blood lactate accumulation and enzyme activities in m. vastus lateralis in man. (in English)

B. Sjödén and others

A previous study reported the close connection between marathon running and the running speed, when lactic acid accumulates in the blood ( $V_{OBLA}$ ) in a group of marathon runners. By means of biopsy material from m. vastus lateralis from the same experimental group ( $n = 19$ ) in the present investigation we have studied the connection between  $V_{OBLA}$  and various muscle enzyme activities together with muscle fibre composition and capillary density. The activities of lactate dehydrogenase (LDH), phosphor-fructokinase (PFK) and citrate synthetase were determined.  $V_{OBLA}$  was negatively correlated with LDH ( $r = 0.54$ ) and PFK/CS ( $r = -0.68$ ). In multiple regression analysis the ratio PFK/CS together with capillary density accounted for 61% of the variation in  $V_{OBLA}$ . The level of training expressed as the number of km run per week was the most significant measured variable, and accounted for 77% of the variation in  $V_{OBLA}$ .

The test subjects were divided into star ( $n = 6$ ) and non-star runners ( $n = 13$ ) for a further analysis of the relation between  $V_{OBLA}$  and the ratios PFK/CS or LDH/CS. A significant relation between  $V_{OBLA}$  and the above ratios was determined only in the non-star runners ( $r = -0.77$  and  $-0.66$  respectively). The vertical distance between the regression lines for these two groups cannot be explained in the context of the ratios of enzyme activity alone. The greater adaptation to fat combustion in the star runners can account for the disproportionately high  $V_{OBLA}$  in relation to the activity ratios of PFK/CS or LDH/CS.

Offprint from Int. J. Sports Medicine (1981), 2, pp 166-170;

FOA Reprints 1981/82:24

(211) FOA Report C 54040-H1

Mould formation on rot-proofed combat equipment

W. Thorsell and others

May 1982

Combat equipment which with special permission had been treated with pentachlorophenol showed a growth of mould (Penicillium species) despite the treatment. However samples from mouldy batches of equipment showed a lower content of pentachlorophenol than batches from non-mouldy equipment.

- (212) FOA Report C 54041-H1  
 Preliminary analytical data on some wild plants previously used as food or emergency food in Sweden. II Less commonly-considered emergency food plants.  
 Stefan Källman June 1982

The account of analytical data on Swedish wild plants is continued in this part with the emphasis on some less commonly considered emergency food plants.

Carbohydrates, protein, minerals and vitamin C are reported for about 20 species.

Of the inner bark of trees, pine has the highest content of carbohydrate and the most acceptable composition. Grey lichen among the lichens has the highest content of carbohydrate, while black lichen has a remarkably high protein content. Leaves of *Aegopodium podagraria* (Goutweed or Ground Elder) have a high protein content, which is also the case for most green parts of the plants examined. The pith of the root of the reed mace has a very high starch content and is a very important emergency food. Reed rhizomes have a high saccharose content and a very sweet taste, as distinct from other roots.

Birch sap can also form a very important source of carbohydrate in emergencies. The amount which can be tapped may be very abundant. Its rate of flow is greater in northern Sweden, but on the other hand the sugar content is rather lower than in birch sap tapped in the Stockholm region.

Vitamin C content is usually very low in berries with the exception of black currants.

The green parts of plants analysed have a relatively high vitamin C content, young birch leaves and spruce in the winter being particularly rich in vitamin C.

- (213) FOA Report C 58012-H1  
 Report of a study visit to physiological diving laboratories in the USA and Canada, with particular reference to hydrox  
 Hans Örnham May 1982

During the autumn of 1981 a 16-day study visit was paid to the USA in order to study hyperbaric physiological laboratories in which hydrox is used. Hydrox is a mixture of hydrogen ( $H_2$ ) and oxygen ( $O_2$ ), which it is planned to use as a breathing atmosphere in deep-diving experiments under the auspices of FOA. The laboratories visited were the Marine Biology Laboratory, Wilmington, North Carolina; Sea Space Research, Harvey, Louisiana; Texas A&M University, College Station, Texas. It emerged during the visit that relatively simple techniques were used at all the laboratories with great success. Only one near-accident occurred in connection with the handling of hydrogen. Research on hydrogen as a breathing gas was conducted in the USA from 1965-75, and was discontinued on achieving the specified objectives. It was found during the visit that interest has been revived in hydrox as a breathing gas. Visits were also paid during the trip to some other physiological laboratories where hydrox is not used, but which were thought to be of interest on the subjects of hyperbaric physiology and diving medicine. These are Duke University, North Carolina; State University of New York at Buffalo, New York; University of Texas Health Science Centre, Houston, Texas; Naval Medical Research Institute, Bethesda, Maryland; and Defence and Civil Institute of Environmental Medicine, Toronto, Canada.

H2 Man and technical systems

- (214) FOA Report C 53006-H2  
 Reading text from visual display units (in English)  
 Yvonne Waern and Carl Rollenhagen May 1982

The present report contains an analysis of the tasking situation in the reading of text from visual display units. A review is given of psychological research concerning various aspects of this task. Situational factors are dealt with first. It is assumed that the visual display situation can cause fatigue and stress, which may lead to impaired performance. This is followed by an analysis of the task, in which some likely advantages and disadvantages of VDU presentation are singled out. Psychological research dealing with textual comprehension is discussed next. Special emphasis is placed on research methods and formation of theories in this field. Finally some conclusions are presented for research planning and studies of VDU presentation of textual material.

- (215) FOA Report C 56031-H2  
 Distance estimation in projected photographs (in English)  
 Henry Widén April 1982

An experiment was carried out to study the differences if any between estimates of long distances on the ground and of the same distances in projected photographs. Nineteen test subjects formed estimates in metres of seven distances (205-1070 m) on the ground, and 35 subjects estimated the same distances on pictures of the ground. Angles of sight were the same under both circumstances. The viewing distance in the photograph situation was 150 cm. Results showed a systematic underestimation which increased with distance. Scatter was wide and increased as a function of the true distance. A variance analysis showed there were no significant differences between estimates under the two conditions. The results thus indicate that ground can be simulated by means of projected photographs. Such simulation can afford several advantages over field tests, *eg* better experimental control, simpler administration and lower costs.

- (216) FOA Report C 59004-H2  
 Prediction of anthropometric measurements for Swedish pilots in AD 2001  
 Thord Lewin and Ove Wilson April 1982

As a basis for the forecast the report gives an account of current and future secular increases in body length in Swedish men and changes in body length in candidates for pilot training. Body length, seated height and body weight in candidates for pilot training are also presented in comparison with those liable for enlistment, and in active pilots compared with conscripts of the same ages. The information includes studies of the drop-out rate among men liable for enlistment and candidates for pilot training at different limits of the intervals for body length. Body length is applied as a limiting variable for selection for determining the limiting values for seated height and body weight as the governing variables. Differences are reported in methods of defining and measuring seated height. The rules for admission concerning the physical profile were tested against candidates for pilot training and men liable to enlistment. As a point of departure in forecasting for pilots in AD 2001, minimum and maximum values were chosen, both with body length as the limiting variable and with seated height as a determining variable. The limiting values for seated height and body weight proposed in the forecast were tested against candidates for pilot training with an analysis of how the intervals

of these variables when taken together exclude individual candidates. Forecasts for certain other body measurements were also made. On the basis of this information suggestions are offered for the specification of pilots in the coming generation of combat aircraft. In terms of this forecast for the rising generation of pilots suggestions are offered for the limiting values of body measurements in candidates for pilot training. Some consequences are stated of the new recommended anthropometric values for space allowances in aircraft and for the current and future regulations for admission. In conclusion certain modifications are proposed for the designation of measurements, definitions and measuring methods. In view of the scope of the report it concludes with a comprehensive summary.

### H3 Man and social systems

#### (217) FOA Report A 59003-H3

A technique for long-term measurements of thyroid function in beagle dogs using  $^{125}\text{I}$  (in English)  
John M. Stone (USA) and others December 1979

After a single dose of  $^{125}\text{I}$  at 1.85 MBq (= 50  $\mu\text{Ci}$ ) the relative thyroid activity can be estimated over 3-6 months by plotting the decrease in radioactivity. The usefulness and sensitivity of the method were demonstrated by experimental studies in which the thyroid activity was varied.  $^{125}\text{I}$  appears to be preferable to  $^{131}\text{I}$  in this type of study.

It is possible to use this method to calculate the absolute values of thyroid activity by introducing correction factors.

#### (218) FOA Report C55051-H3

Research and change in organisations - evaluation of an Organisation Development (OD) project.  
Åke Philips and Anders Risling March 1982

The article describes an OD project at a military school. This project was directed on the lines employed in the US Army. The purpose of the study among other things was to study this type of introduction of change through behavioural science. The principles followed when evaluating the project were those of operational research. The results, which were structured in structural changes and changes of attitude, demonstrate that certain decisive changes occurred because of the introduction of change. However some other problems which were noted at the outset of the project have not yet been tackled. Some measures are suggested for the continued introduction of change at the school.

The results are interpreted in terms of sociological, pedagogical and psychological theory, and illustrate that this application of OD can be used successfully to render an organisation more efficient.

The article concludes by discussing various means of developing methods for the introduction of change, and some methods for evaluating the introduction of change.

#### (219) FOA Report C 55052-H3

Does the introduction of change lead to change? Test of a model of change  
Ebbe Blomgren and Berit Ståhlberg Carlstedt April 1982

The productiveness of a model of change which is formulated at the beginning was tested by means of an empirical example - a project on the introduction of change which had been previously conducted. The test was applied against a criterion: the model and its concepts should provide an understanding of the outcome of the project.

The model was then modified, and now states briefly that the ideology behind any change should lead to corresponding structural changes over and above any influence on attitudes. In addition the changes should be integrated into the everyday work. When this has happened it means a genuine change, which implies among other things that a change of attitude has occurred in those involved.

It is suggested that future work on the model should include both a deepening of the theory and practical testing in the planning and implementation of future projects on the introduction of change.

(220) FOA Report C 55053-H3

The prediction of military groups' effectiveness by the coherence of their appraisal (in English)  
Ben Shalit April 1982

A model is presented, Appraisal Integration Model (AIM). It describes a sequential process of judgment and relates the various stages of 'orientation' (acuity of the perceptual structure), 'valence' (the subjective commitment) and 'coping' (the feeling of control) to how effectively a situation is tackled. In order to map the process of judgment described above an instrument has been designed, (the Wheel Questionnaire - WQ). This is an unstructured question form without any fixed alternative responses. Various indices which measure the three stages can be calculated from the pattern of answers alone; thus the content does not need to be processed. The question asked was, "In your view what characterises war?". The three indices were evaluated as predictors of military effectiveness. Fourteen groups from a fighter unit in northern Sweden (K4) were judged on three criteria, which were used to validate the indices as predictors of military effectiveness. The three criteria were the troops' assessment of their own group, the assessment by conscripts at company HQ of the groups, and an index based on frequency of reporting sick and absence through sickness. The results clearly demonstrated ( $r = 0.50$  to  $0.68$ ) that the index 'orientation' predicted all the criteria, 'valence' predicted the troops' assessments, and 'coping' predicted the troops' assessments and absence through sickness. It was also found that agreement in the troops' assessment (in the WQ) had a predictive value of its own.

(221) FOA Report C 55054-H3

Evaluation of Organisation Development (OD) - a literature review (in English)  
Ake Philips May 1982

In order to increase our knowledge of organisation development (OD) in theory and practice, we need to make evaluations of actual OD which are both valid and applicable. The purpose of this review of the literature is to supply a general map of the tangled undergrowth of which OD consists, together with a concise presentation of the more detailed maps which are available elsewhere. The ultimate purpose is to aid anyone who is evaluating OD to form suitable principles of evaluation. Each evaluation should be formed having regard to the circumstances of a particular evaluation situation. The report discusses the following central considerations in the evaluation process:

choice of objective and target group,  
statement and choice of evaluation criteria,  
choice of variables for evaluation,  
choice and/or design of measurements and measuring instruments,

and construction of an optimum evaluation design.

The simplest conclusion in the report is that the validity and applicability of OD evaluations can be increased by a greater awareness of these important considerations. Another tentative and rather provocative conclusion is also presented: Many evaluators of OD activities and likewise their critics are locked into the traditional standards of normal science. Some new and complementary forms of approach to the evaluation of OD can be developed within the theories such as operational research and a paradigm of interpretation.

M INTERDISCIPLINARY STUDIES AND INVESTIGATIONS

M3 Security aspects of environmental studies

(222) FOA Report C 10189E-M3

Sweden and nuclear weapons

Gunnar Jervas

(in English)

September 1981

Various events have recently emphasised the problems of nuclear weapons. In this situation it was felt appropriate to subject Sweden's policy on the matter to scrutiny.

This study falls into three principal sections, the first of which considers Swedish policy on nuclear weapons in historical terms. In section 2 an attempt is made to identify the current policy as it emerges from the present thinking of the Defence Committee. Section 3 contains a critical assessment of the views of the Committee, with an attempt to take the analysis further, especially as regards the threat scenario. The question of some likely precautionary planning continues to be a subject of investigation.

In view of the fact that a debate on nuclear-free zones is in progress, this question is also discussed.

This study forms part of the "Trend Project".

(223) FOA Report C 10205-M3

The GDR between East and West

Iréne Nilsson

March 1982

The most important concession by Moscow during the early stage of the détente period was to permit the development of intra-German relations on a number of different fronts. The result was an intensified cooperation between the two German states, which today has its own momentum.

Standing at the centre of this study is the development of intra-German relations during the early 1980s. The study seeks an answer to the question of what was the reason for the German-German dialogue being broken off during the autumn of 1980, and what lay behind the expressed wish during the spring and summer of 1981 to resume the fragile thread of talks. In addition the study raises the question of whether the decision for détente or distancing from the FRG lay in Moscow or East Berlin. In order to answer this question, the role played by the GDR in the German policy of the Soviet Union is discussed. Soviet policy on Germany is seen here as a triangular game, in which her policy to one German state can be partly predicted from her policy towards the other. Against this background three alternatives are discussed for the future developments of intra-German relations.

This study forms part of the "East Project".



(224) FOA Report C 10206-M3  
The Soviet Union and Western Europe  
Lena Jonson

April 1982

The present study discusses Soviet intentions and objectives in Western Europe and their consequences for the security of Western Europe.

One general conclusion is that the influence of the Soviet Union on Western Europe, particularly as regards the Federal German Republic, is showing a tendency to increase. However there does not exist any definite position of dependence. West Germany continues to be regarded as capable of breaking the tendency in question.

This study forms part of the "East Project".

M6 Information systems

(225) FOA Report C 10166E-M6 (H9)  
Experience from using the KOM teleconference system  
Jacob Palme

December 1981

The KOM computerised teleconference system has been in regular operation at the Stockholm Data Processing Centre for higher education and research since March 1979. This report summarises in 33 pages the result of a number of analyses of the effects of the system. The report includes in an appendix a complete account of those analyses which had not been published as separate reports. The report also considers some results of evaluations of other teleconference systems of a similar type.

It gives an account of how much KOM is used, what KOM is used for, who communicate via the KOM system, what the users think of the advantages and disadvantages of the KOM system, and it compares the cost with other means of communication.

The result shows that a certain portion of communication which used to go via telephone, letter or meeting is now going via the KOM system. But much of the communication via KOM is newly-acquired communication. KOM has changed the pattern of communication and increased communication between people who are widely separated organisationally, especially for younger employees and those who are not managers.

For many users KOM has enlarged the circle of people with whom they exchange experiences, and has meant that information and opinions can be both extended to and gathered in from several people more rapidly than it used to be.

T CERTAIN MEASURES FOR LIMITATION AND CONTROL OF ARMAMENTS

T1 Seismological multiple stations

(226) FOA Report C 20454-T1  
Common database experiment - depth estimation using multistation data (in English)  
Falguni Roy

April 1982

Determinations of depth for seismic events which are based on arrival times from different stations, known as Level I data, are uncertain parameters in many cases. A procedure which provides better determinations of depth is therefore desirable both in order to distinguish explosions from earthquakes and for a geophysical understanding of earthquakes.

The present report describes a procedure for determining depth which attempts to identify what are termed depth phases by analysing waveform data from a large number of

measuring stations. For this purpose several types of signal analysis are employed such as deconvolution, various kinds of filtering and spectral analysis. If no depth phases can be observed, then time-differences between other signals are used, *eg* S-P, ScS-P and SKS-P. The waveform data used in this study were collected from 31 measuring stations worldwide during the period 1-15 October 1980.

The digital measurements, which form part of the International Database Experiment, were analysed at the temporary data centre in the FOA.

It was found possible to calculate new depths for 120 out of 162 events of magnitudes between 3.5 and 6.2 defined by means of Level I data. For the data in question here the method employed has 100% applicability for events with  $m_b > 4.8$ , and 88% for events with  $m_b > 4.0$ . The uncertainty of depth determination obtained from analysis of waveform data is estimated at about 10%. A comparison between Level I and Level II (waveform) depths shows that it is necessary to have at least one station situated less than 1000 km from the event in order to obtain an accurate depth determination based on Level I data alone. A considerably denser worldwide network than the one hitherto proposed would therefore be required.